HERA IPERSPETTRALE - APPLICATION NOTE

Analysis on mortar fragments from *Villa Adriana*, Tivoli (Rome)

NIREOS

Hyperspectral imaging (HIS) is a powerful tool for the analysis of works of art. It represents indeed a **non-destructive, fast and accurate** methodology, suitable for delicate samples such as artworks. Moreover, the characteristics of the HERA Iperspettrale, make it particularly suitable for measuring works of art. The camera, based on a novel Fourier-Transform approach, guarantees high-quality data even at **low illumination intensities**, which is typically recommended in the cultural heritage field in order not to damage the works of art. The camera features a high spatial (1280x1024 pixels) and spectral resolution (1.5 nm at 400 nm wavelength), a broad spectral coverage (400 – 1000 nm) and an easy **point-and-shoot approach**, without requiring any moving parts. In the present works some fragments retrieved from the Villa Adriana archaeological site are analysed in order to identify the pigments employed by the roman artists. The results are validated by previous studies on the samples.

ADVANTAGES OF USING HERA

- High sensitivity
- Broad spectral range (400–1000 nm)
- High spatial and spectral resolution
- Plug & Play
- Non-destructive measurements
- Point-and-shoot approach
- Low illumination required

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Pigment's identification:

Villa Adriana has been an Imperial Roman Villa built by emperor Hadrian between 117 and 138 AD. It has been declared a UNESCO World Heritage site in 1999. In the present work some mortar fragments rediscovered in the Villa archaeological site have been analysed with the HERA camera. By comparing the spectra obtained with the hyperspectral camera with the ones stored in the FORS (Fiber Optics Reflectance Spectroscopy) database from Cultural Heritage Open Source (CHOS) it has been possible to identify the pigments used by the artists in the Villa decorations.

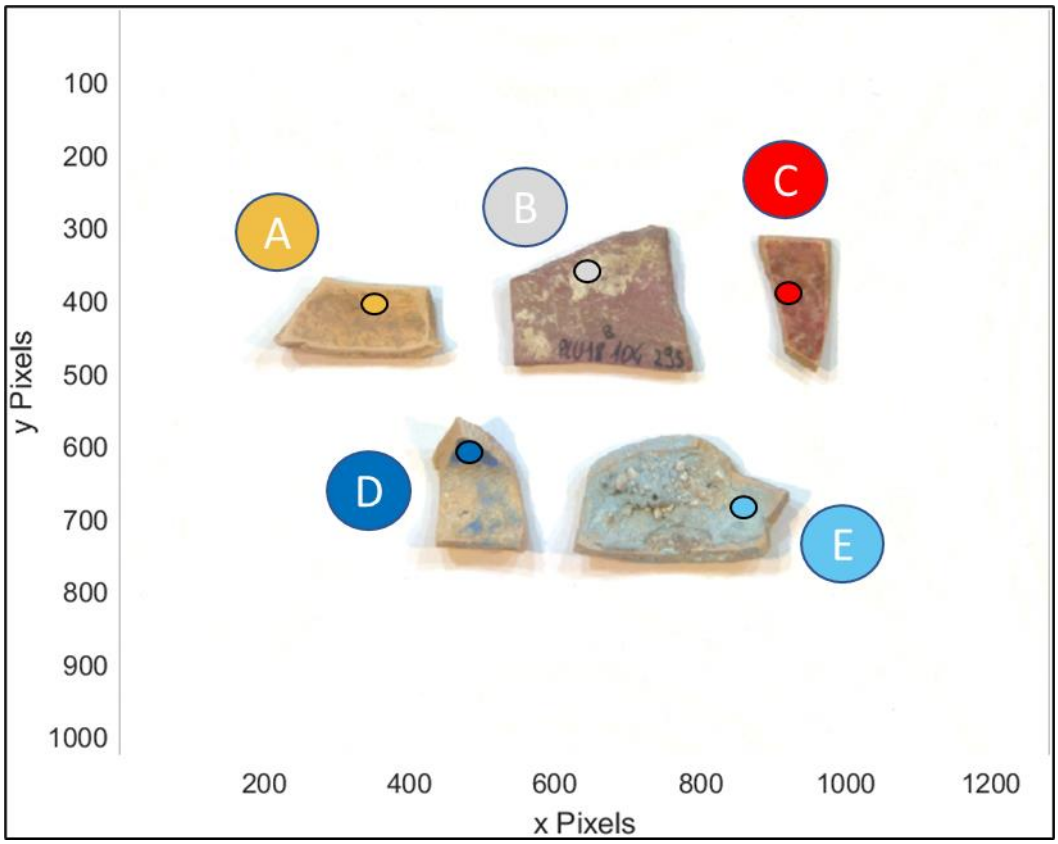

Figure 1: *RGB reconstruction of the analysed samples obtained from the hyperspectral data*

The mean spectra referring to the highlighted areas in Figure 1 (labelled as A-E) are shown in the following Table 1 (in the column Measured spectra). For each fragment is then reported the most similar spectra in the FORS database. The comparison between the two spectra enables the correct identification of the corresponding pigment contained in the mortar.

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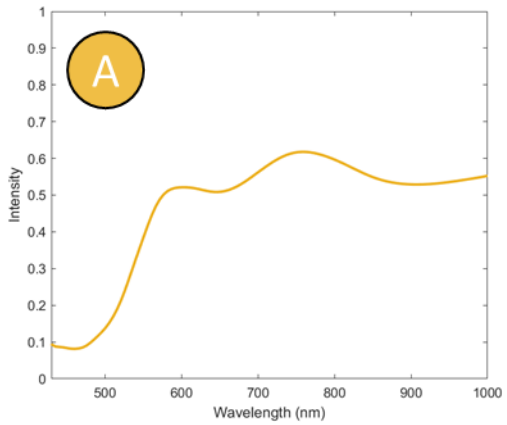
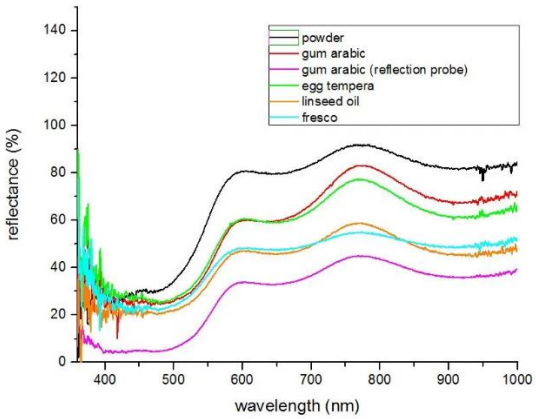
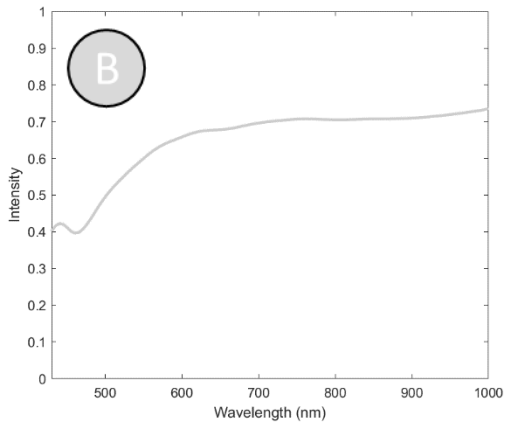
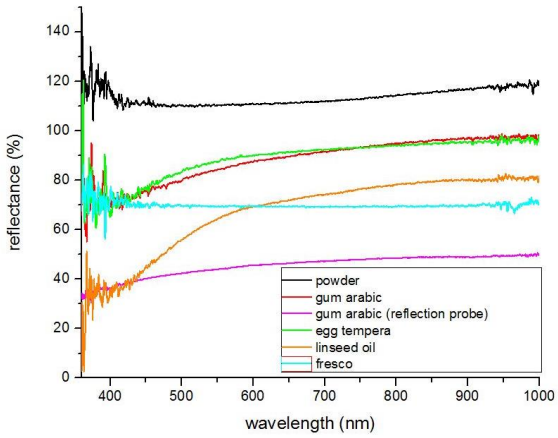
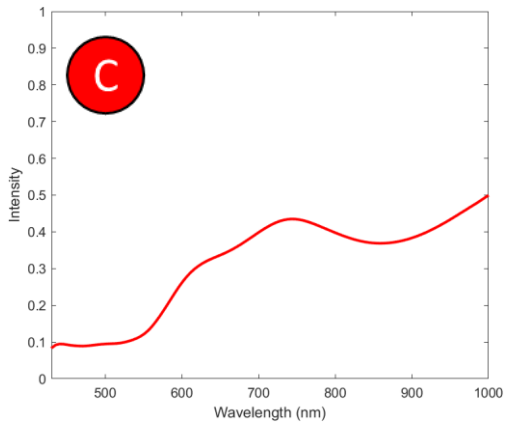
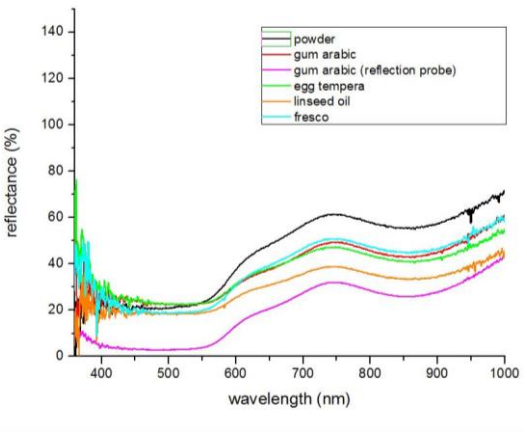
Measured spectra	Reference spectra	Identified pigment
		Yellow Ochre
		Gypsum
		Red Ochre

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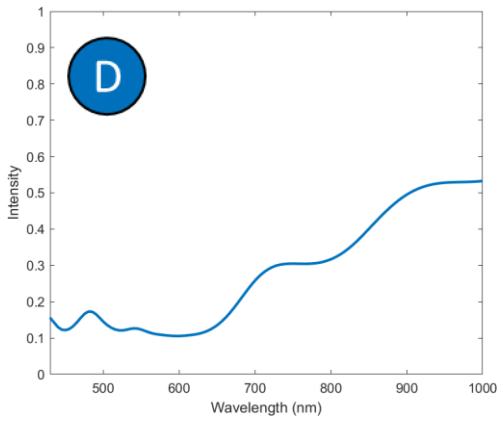
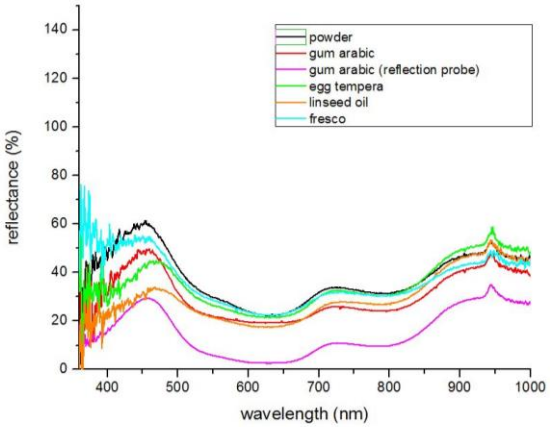
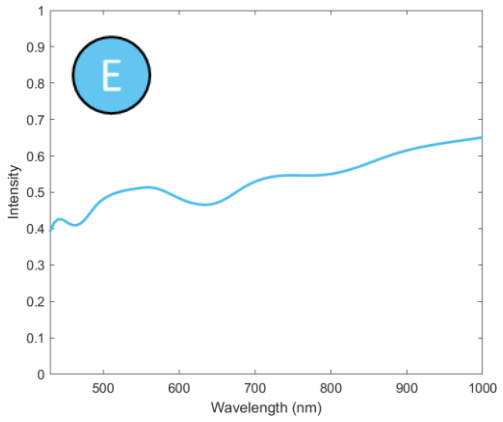
		Egyptian Blue
	No good match has been found with the spectra in the database. Possibly in this fragment it is present a mixture of different pigments.	

Table 1: *Comparison of the measured spectra with the ones stored in the CHOS database, enabling pigment's identification*

From the hyperspectral analysis it is found that for the decorations of the Villa some precious pigments have been employed such as the Egyptian Blue, in agreement with the imperial status of the Villa, together with more common pigments such as the red and yellow ochre. The obtained results are in agreement with previous studies performed on other remains rediscovered in Villa Adriana [1].

[1] P. Fermo, E. Delnevo, M. De Vos and M. Andreoli, "PAINTING AND MORTARS FROM VILLA ADRIANA, TIVOLI (ROME, ITALY)", 2009. E-Preservation Science. 6. 169-173.